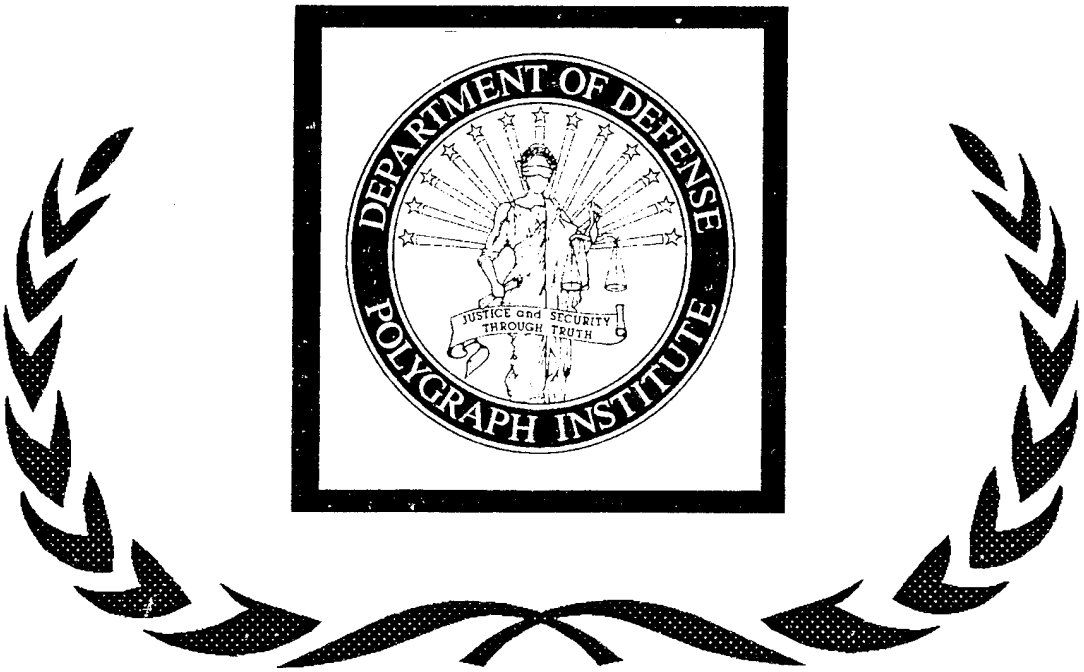



# An Analysis of Voice Responses for the Detection of Deception

Victor L. Cestaro, Ph.D. and Andrew B. Dollins, Ph.D.

June 1994

Department of Defense Polygraph Institute
Fort McClellan, Alabama 36205-5114
Telephone: 205-848-3803
FAX: 205-848-5332

# REPORT DOCUMENTATION PAGE

*Form Approved*
*OMB No. 0704-0188*



| 1. AGENCY USE ONLY *(Leave blank)* | 2. REPORT DATE | 3. REPORT TYPE AND DATES COVERED |
|---|---|---|
| | June 1994 | Final Report (From Feb 93 - Jun 94) |

**4. TITLE AND SUBTITLE**
An Analysis of Voice Responses for the Detection of Deception

**5. FUNDING NUMBERS**
DoDPI93-P-0024

**6. AUTHOR(S)**
Victor L. Cestaro and Andrew B. Dollins

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
Department of Defense
Polygraph Institute
Building 3165
Fort McClellan, AL 36205-5114



**8. PERFORMING ORGANIZATION REPORT NUMBER**
DoDPI94-R-0001

**9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)**
Department of Defense
Polygraph Institute
Building 3165
Fort McClellan, AL 36205-5114

**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**
DoDPI94-R-0001
DoDPI93-P-0024

**11. SUPPLEMENTARY NOTES**



**12a. DISTRIBUTION/AVAILABILITY STATEMENT**
Public release, distribution unlimited.

**12b. DISTRIBUTION CODE**

**13. ABSTRACT** *(Maximum 200 words)*

This study was designed to examine the feasibility of using audio pitch analysis and spectrum decomposition techniques to aid in the detection of deception following a numbers test. Usable audio recordings from 28 of 44 male subjects' responses during a Peak of Tension (POT) test were made while a Lafayette field polygraph was used to collect respiration, cardiovascular, and electrodermal responses for manual evaluation. Half of the examinees were programmed "deceptive" and half were programmed "truthful". Off-line analysis using pitch and spectral analysis software to examine differences between truthful and deceptive "no" responses disclosed no significant differences were found between the two groups between the two groups on individual measures of pitch variation, response duration, or mean response energy. A significant concurrence rate ($p < .01$) was seen between decisions made by pitch/energy analysis and the examiner's decisions based on analysis of the test data. Significant differences were found between the number of correct decisions made by the examiner (79%) and by pitch/energy analysis (37%). No significant differences were seen between the number of false positive decisions made by the examiner and by pitch/energy analysis (35% versus 29%).

**14. SUBJECT TERMS**
voice analysis, voice pitch, voice stress, detection of deception, fundamental frequency, spectrum analysis, vagal, parasympathetic, polygraph

**15. NUMBER OF PAGES**
38

**16. PRICE CODE**

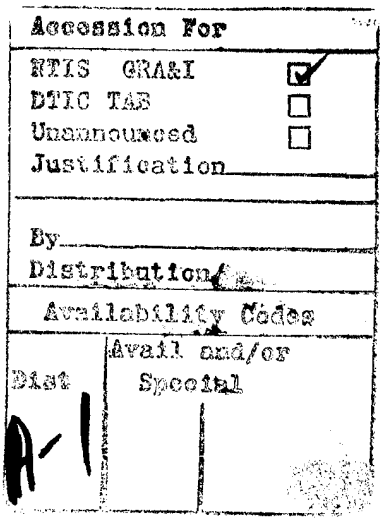
| 17. SECURITY CLASSIFICATION OF REPORT | 18. SECURITY CLASSIFICATION OF THIS PAGE | 19. SECURITY CLASSIFICATION OF ABSTRACT | 20. LIMITATION OF ABSTRACT |
|---|---|---|---|
| Unclassified | Unclassified | Unclassified | |

Report No. DoDPI94-R-0001

# An Analysis of Voice Responses for the Detection of Deception

Victor L. Cestaro, Ph.D. and Andrew B. Dollins, Ph.D.

June 1994




Department of Defense Polygraph Institute
Fort McClellan, Alabama 36205

## Director's Foreword

This was the first study, in what will be a series of studies, to explore a variety of voice stress analysis methods and systems. The purpose of this line of research is to determine (1) if the data collected by any particular voice stress recording device, evaluated by a variety of visual and/or algorithm systems, can discriminate between individuals responding truthfully and those responding deceptively; (2) if detection of deception tests, using voice stress data, can supplement or supplant traditional approaches to psychophysiological detection of deception (PDD) tests; and (3) validity and reliability data for voice stress tests. Although the results of this study did not resolve or answer any of the above issues, further research is nevertheless warranted.

In recent years, there has been a revival of voice stress applications in PDD testing. In particular, the Computer Voice Stress Analyzer (CVSA) promoters have been actively advertising, selling and training examiners across the country. Agencies that have purchased the equipment; and, many that are contemplating the purchase of this equipment, are vitally interested in obtaining validity and reliability data that will support or reject the claims of CVSA promoters. Subsequent research projects will center on the CVSA and the test procedures developed for that instrument.

William J. Yankee, Ph.D.
Director

Acknowledgements

The authors wish to express special thanks to: the volunteers who participated in the study; Charlene L. Stephens, Master Sergeant Randall S. Reynolds, Dr. Donald J. Pettit, and Larry R. Broadwell for their assistance throughout data acquisition and processing. This research was supported by DODPI94-P-0024 project funds from the Department of Defense Polygraph Institute. The views expressed in this article are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

Abstract

CESTARO, V. L. and DOLLINS, A. B. An analysis of voice responses for the detection of deception. June 1994, Report No. DoDPI94-R-0001. Department of Defense Polygraph Institute, Ft. McClellan, AL 36205.--This study was designed to examine the feasibility of using audio pitch analysis and spectrum decomposition techniques to aid in the detection of deception following a numbers test. Audio recordings were made of 44 male subjects' responses during a peak-of-tension (POT) test. A Lafayette field polygraph was used to collect respiration, cardiovascular, and electrodermal responses for manual evaluation. Half of the examinees were programmed "deceptive" and half were programmed "truthful". The audio recordings of the subjects' responses were analyzed off-line using pitch and spectral analysis software to examine differences between truthful and deceptive "no" responses. Useable voice recordings were obtained from 28 of the original 44 subjects. No significant differences were found between the two groups on individual measures of pitch variation, response duration, or mean response energy. A significant concurrence rate ($p < .01$) was seen between decisions made by pitch/energy analysis and the examiner's decisions based on analysis of the test data. Significant differences were found between the number of correct decisions made by the examiner (79%) and by pitch/energy analysis (37%). However, no significant differences were seen between the number of false positive decisions made by the examiner and by pitch/energy analysis (35% versus 29%).

Key-words: voice analysis, voice pitch, voice stress, detection of deception, fundamental frequency, spectrum analysis, vagal, parasympathetic, polygraph

## Executive Summary

CESTARO, V. L. and DOLLINS, A. B. An analysis of voice responses for the detection of deception. June 1994, Report No. DoDPI94-R-0001. Department of Defense Polygraph Institute, Ft. McClellan, AL 36205.

The utility of voice analysis, as a psychophysiological detection of deception (PDD) tool, was examined in this study. The primary objective was to identify a measure, or combination of measures, that is indicative of stress associated with deception. Audio analysis techniques were used to assess verbal responses.

Forty-four males participated in peak-of-tension (POT) numbers tests during the study. Half of the participants were instructed to be deceptive in their responses during the examination and the remaining half were instructed to be truthful. All PDD examinations were conducted by an examiner who had completed training at the DoD Polygraph Institute. All subjects completed a number search task prior to the examination and were asked questions pertaining to the selected number during the examination. Each subject participated in six repetitions of a seven question examination. All subjects were instructed to respond "no" to each question regarding the numbers from 60 to 66. Truthful subjects had not selected a number within the range of the questions. Verbal responses were tape-recorded and subsequently digitized for computer analysis. Complete recordings were obtained and analyzed from 28 of the 44 subjects. In addition to spectral energy distribution of the voice response, the fundamental frequency, response energy, response duration, and pitch variations around the fundamental frequency were examined.

Results of the analyses suggest that no single human voice measure, as collected and analyzed in this study, can reliably discriminate between truthful and deceptive responses. However, some systematic changes were detected when features consisting of multiple measures were extracted from pitch information. Further research should be conducted to examine features extracted from the frequency domain as additional PDD discriminators.

Table of Contents

List of Figures

Standard psychophysiological detection of deception (PDD) tests and procedures have historically used measures of autonomic nervous system reactivity to differentiate between deceptive and non-deceptive subjects. Changes in skin resistance, breathing rate, and cardiovascular activity in response to questions requiring a "yes" or "no" answer have been the most common measures. In most cases, decisions are based on analysis of the physiological data recorded using four polygraph channels (cardiovascular, electrodermal, and two respiratory channels). There have been no additional channels added to the traditional polygraph since its inception as a tool designed for the PDD. However, various attempts have been made in the past to detect deception using voice stress analysis (O'Toole, 1975). Interest in this method was reported more than five decades ago in a study conducted by Fay and Middleton (1941) who relied on human judgments of voice responses to determine truth or deception. Forty-seven subjects were told to answer a series of ten questions either truthfully or untruthfully. Instructions to lie or tell the truth were presented immediately before each response, and subjects' responses were judged by a panel of 60 observers. Correct judgments were at or near chance levels, with judgments of "lie" answers slightly better than truthful answers (60.99% vs. 50.05%).

Using more sophisticated techniques, Motley (1974) examined extracted pitch information from voice responses in an attempt to detect involuntary (autonomic) manifestations of stress related to deception. Twenty female subjects were instructed to respond "no" to a series of questions related to a number picked prior to the experimental session. Analysis of recorded responses examined intensity, fundamental frequency, duration, formant structure, and harmonics. The only difference found between truthful and deceptive responses was in the response duration measure ($p < .01$). A second procedure in this experiment showed that acoustic cues associated with deception were not detectable by the unaided ear at better than chance levels, which lends support to the results obtained by Fay and Middleton (1941).

Other investigators have demonstrated an interest in the pitch component as an indicator of emotional content in speech (Lieberman, 1961; Lieberman & Michaels, 1962). Lieberman and Michaels (1962) stated that observers were able to correctly identify specific emotional states of subjects 85% of the time when unprocessed speech was presented to them. Using speech synthesis techniques, they found that identification accuracy dropped to 25% when pitch information within the raw speech waveform was smoothed. Their conclusion was that pitch perturbations in human speech were important to the transmission of emotional information, and that this was an "acoustic correlate of some phonetic or emotional event".

In another study focusing on pitch changes, Streeter, Krauss, Geller, Olson, and Apple (1977) found that subjects' average response fundamental frequency (F0) was higher when they were being deceptive than when telling the truth. In addition, they found that the magnitude of this difference was marginally greater when the deceptive act was stressful or arousing. Tolkmitt and Scherer (1986) reported that mean F0 is less sensitive to stress than F0 floor, and that F0 floor may be a better indicator of stress (F0 floor rises when arousal increases). F0 floor was defined as the final F0 value of a speaker's declarative statement.

Another method, commonly referred to as PSE (psychological stress evaluation), has met with varying degrees of success (Barland, 1978; Brenner, Branscomb, & Schwartz, 1979), but has never been widely accepted by PDD examiners as a reliable tool. This lack of acceptance may largely be due to the fact that PSE was meant to replace rather than augment the standard polygraph, and by itself may not provide sufficient information for confident judgment. A major drawback is that PSE appears to rely solely on changes in the FM (frequency modulation) component of speech, most often referred to as microtremor, for the detection of deception. The reliability of the relationship between voice microtremor and autonomic reactivity has not been well established. Evidence from controlled studies shows that voice stress analyzers fail to yield deception detection rates above chance levels (Horvath, 1982).

The present study was designed to examine the verbal responses of subjects to determine if features within the acoustic components are related to deception. Analyses were performed on the pitch contours (time domain) and spectral energy patterns (frequency domain) of subjects' voice responses during a peak-of-tension (POT) numbers test. The FM component, mean dominant (fundamental) pitch frequency, response duration, and mean response intensity of deceptive and truthful "no" responses were examined. Changes in the magnitude and rate of the FM component were also expected. In the frequency domain it was expected that deceptive responses would result in a spectral energy pattern shift when compared to non-deceptive responses.

## Method

### Data Collection

The data used in this study were collected during a repeated measures study (Dollins, Cestaro, & Pettit, 1994). A complete description of the procedures used throughout data collection is included for accuracy, though many of the procedures were not directly related to this voice analysis study.

### Subjects

Forty-four, native English speaking, healthy males [mean age (SD) = 29.2 (7.8) years; range = 19 to 47] participated in this study. Volunteers were civilian or military Department of the Army employees and were not paid for their participation. Thirty-nine of the volunteers had never participated in a PDD examination before. The remaining five volunteers had not participated in a PDD examination within the last two years. Thirty-five of the volunteers reported themselves to be medication free. The remainder were ingesting pain / relaxant (3), anti-inflammatory (1), antibiotic (2), or antihistamine (3) medication. Females did not participate in the repeated measures study because of possible variations in skin resistance (over time) caused by hormonal secretions associated with the menstrual cycle. The data of 16 subjects were excluded because response amplitude was too low, leaving 28 subjects' data for analysis. Six of these subjects were using one of the above-mentioned medications.

Examiner

All PDD examinations were conducted by the same examiner. The examiner had completed training at the Department of Defense (DoD) Polygraph Institute (Fort McClellan, AL) and was certified as a PDD examiner by the Department of the Army. He had administered approximately 500 field examinations during the five years prior to the study and was an instructor at the DoD Polygraph Institute.

Apparatus

Data were collected using a Lafayette (Lafayette, IN) Factfinder (Model 76740/76741) polygraph equipped with three Cardio/Aux/Pneumo/GSR modules (Model 76477-G), one GSR module (Model 76480-G), and one electronic stimulus marker module (Model 76351-GET). A circuit was added to the electronic stimulus marker module to allow control of the marker via signals from a computer RS-232 serial port. Lafayette sensors were used to measure skin resistance (Model 7664), respiration (Model 76513-1G & 76513- 2B), and cardiovascular activity (Model 76530).

A stimulus presentation micro-computer (Model 248, Zenith Data Systems, Chicago, IL), was used to replay questions throughout testing. The questions used throughout PDD testing were digitized and recorded to computer hard disk using a Sound Blaster board (Model 16ASP, Creative Labs Inc, Milpitas, CA). A parallel port interface (Speech Thing, Covox Inc., Eugene, OR), connected to a Radio Shack (Fort Worth, TX) integrated stereo amplifier (Model SA-155) and two speakers (Model Minimus-77) was used to present the questions. This system ensured that each question was presented with the same inflection, and at the same volume, each time it was asked.

Subjects' verbal responses were recorded on cassette tape using a Tascam Model 134 4-channel recorder (TEAC, Montebello, CA) and a lavaliere microphone (Model 570S, Shure, Evanston, IL) positioned mid-chest and held in place by a cord placed over the examinee's shoulders. The recorder was located in an adjacent room. Excerpt recording was controlled via the software running on the stimulus presentation computer. The stimulus presentation computer serial port and an in-house built interface for the cassette recorder were used for this purpose.

A DT2821 data acquisition board (Data Translation, Inc., Marlboro, MA), installed in a standard IBM compatible 486 computer, in conjunction with Canadian Speech Research Environment software (CSRE 4.0, University of Western Ontario, Elborn College, London, Ontario, Canada), was used to acquire and digitize the analog voice signals from audio tape. A TTE 411AFS anti-aliasing filter (TTE Inc., Los Angeles, CA) set to an upper frequency cutoff of 5000 Hz was installed between the tape recorder output and the DT2821 input during conversion of the audio responses from analog to digital format. The voice spectrograms and pitch tracks were printed on 8.5" x 11" paper using a Hewlett-Packard XL300 color printer. Software was written in-house for data reduction and display.

PDD testing was conducted in a carpeted, 11'6" x 12' partially sound-attenuated room. Each examination was recorded on video tape using two ceiling and one wall mounted video camera. The examination was also monitored through a two-way mirror by a collaborator located in an adjacent room.

Subjects were seated in a Lafayette adjustable-arm subject chair (Model 76871, Lafayette, IN) during testing. The chair was positioned beside and slightly in front of the examiner's desk. This position allowed the examiner to monitor the examinee's movements but not vice versa. The polygraph was mounted in a double pedestal examiner's desk (Lafayette Model 76183). The stimulus presentation computer and monitor were on a table next to the examiner's desk and out of the examinee's sight during testing. The speakers, through which the questions were played, were located six feet behind, and one foot above, the back of the examinee's chair. The examinee's field of view, throughout testing, was limited to a wall of uniform color, a stationary video camera, and, above the video camera, a piece of paper with the numbers 60 through 66 and the word "NO" written on it (Appendix A).

Procedure

Participants were randomly assigned to the treatment or control groups, with the constraint that at least one volunteer from each group participate in every fourth examination. That is, no more than three control or treatment group participants were tested consecutively. Twenty-two subjects were assigned to each group. Each volunteer participated in two examination sessions. The two sessions were separated by at least five working days. Subjects completed six PDD tests during each examination session. Only the responses to the numbers 62 to 66 of the first three PDD tests of the first examination session were used for voice analysis in this study. The first two responses (to numbers 60 and 61) were excluded from all analyses to avoid inclusion of possible orienting responses in subjects' data.

Upon arrival at the DoD Polygraph Institute (Fort McClellan, AL), each participant was escorted by one of the investigators to a secluded briefing room and asked to read a brief description of the research project (Appendix B). Individuals indicating that they would participate were asked to read and sign an informed consent affidavit (Appendix C). Any questions were then answered. A brief biographical / medical questionnaire was then completed, to ensure that the participant was in good health and not currently taking medication which could interfere with the PDD examination results (Appendix D).

The participant was required to complete a number search task, which was referred to as an anagram task. During this task, the participant circled six sequences of a two-digit number which was repeated five consecutive times (in any direction) in a 20 x 30 matrix of two digit numbers. The matrix consisted of numbers between 60 and 69 (Appendix E) for the programmed guilty subjects - who circled the number 64, and 80 to 89 (Appendix F) for the programmed innocent subjects - who circled the number 84. When the anagram task was complete, the participant was asked to write his name and the number circled on two 3x5"

cards. One card was retained by an investigator and the second concealed in the participant's pocket. The PDD examination procedure was briefly explained to the participant. It was emphasized that the participant should not reveal which number he had circled during the PDD examination. It was further emphasized that the participant should make every attempt to remain relaxed, even if he felt himself begin to react (increased heart rate, perspiration on hands, tightening of occlusive cuff) during the examination. The participant was then escorted to the examination room and introduced to the examiner.

The examiner greeted each participant, then reviewed the biographical / medical questionnaire with the participant to ensure it's accuracy. No other pre-test questions were asked by the examiner. The examiner then briefly explained the sensors, procedures, and theory of PDD. The examiner explained that the polygraph simply measured the participants physiological reactions - and not deception per se. It was further explained that the participant's physiological responses were likely to change during deception. It was suggested that fear of detection during deception altered the normal physiological response pattern and that these changes may be evident in the recorded physiological data. The examiner described this response as being similar to the fight-or-flight reaction used to describe a fear response during military training (Appendix G).

The examiner reviewed the questions to be asked during data collection with the participant by playing the computer recorded questions. If there were no further questions, the participant was then seated in the examination chair and the sensors were attached. Respiration was monitored using convoluted (pneumo) tubes placed around the upper and lower chest. Skin resistance was measured using electrodes placed, without paste, on the most distal phalanges of right hand index and ring fingers. Cardiovascular activity was monitored using an occlusive cuff placed over the brachial artery of the left arm. The pneumo tube vents were closed and the DC offsets for the pneumo and skin resistance on the custom built amplifier were adjusted to zero. The sensitivity of these recording channels was then adjusted on the polygraph. Next, the occlusive cuff was inflated to 90 mmHg, massaged to remove wrinkles, then deflated to 48 mmHg. The pressure was then adjusted, as necessary, to achieve a 2 mmHg pen deflection, between diastole and systole, on the sphygmomanometer. The custom built amplifier DC offset was then adjusted to zero to keep the signal within the range of the analog-to-digital converter, and polygraph sensitivity adjustments were made.

The following series of statements were made and questions asked, via computer recorded voice, during a single chart:

X The test is about to begin.
01 Did you complete an anagram for the number 60?
02 Did you complete an anagram for the number 61?
03 Did you complete an anagram for the number 62?
04 Did you complete an anagram for the number 63?
05 Did you complete an anagram for the number 64?

06 Did you complete an anagram for the number 65?
07 Did you complete an anagram for the number 66?
XX The test is now complete, please continue to sit still while I turn the instrument off.

Before the examination began, the instructor reminded each subject that the correct response to each question was displayed on the wall directly in front of the subject. If the examiner judged that the physiological signals recorded on the polygraph chart contained artifacts, the previous question was repeated. The examiner played the message "Please remain still" if he judged that the examinee was producing unnecessary and/or excessive movements. When a question series was completed, the pressure in the occlusive cuff was vented and the subject was instructed to "please relax while I prepare for the next test". If subjects appeared to be sleepy, they were also reminded of the importance of the study and encouraged to remain alert. The next PDD test was begun approximately three minutes later. The occlusive cuff was inflated prior to beginning the next test, as described above. This process was repeated until six tests were completed, after which the sensors were removed. The subjects were then asked to read and sign a debriefing form (Appendix H), reminded to return the following week, and escorted out of the building.

Participants returning for a second test session were escorted to a briefing room where they were reminded of the number circled during the previous session and asked to conceal the second card, indicating the number circled, in a pocket. They were reminded not to reveal what the number was to the examiner, then escorted to the examination room. The examiner again reviewed the biographical / medical questionnaire from their previous session to ensure that no changes had occurred. Six additional PDD tests were completed, as described above. When the examination was complete, participants were thanked for their cooperation, asked to read and sign a second debriefing form (Appendix I), and escorted out of the building.

Pitch Data Reduction

Digitized voice responses were processed with CSRE's software comb filter to extract pitch from the raw waveform data. The data acquisition sampling rate was set to 10 Khz. The low-pass filter cutoff frequency was set to 800 Hz prior to smoothing and comb filtering. Extracted pitch waveforms were saved for off-line processing.

Response duration was the unit of time used to convert the number of peaks per response to frequency. The number of peaks per response was determined using a software peak/trough detection algorithm, therefore providing a means to detect deviations from the dominant (fundamental) pitch frequency. This provided a measure of the mean frequency modulated (FM) component of the voice waveform.

The peak excursions (deviation magnitudes) from the dominant baseline frequency were also measured. The mean peak deviation, in cycles, from the dominant pitch frequency was divided by the dominant pitch frequency to determine the modulation index of each sample (e.g., a deviation of 40 Hz from a 400 Hz dominant pitch frequency = 0.10, or 10%

modulation index). This result was then multiplied by the FM component to provide an index of FM energy for each response, normalized over a one second period. Simply stated, the FM component provided a measure of the rate of shift in the dominant pitch component and the modulation index provided a measure of the magnitude of that shift. The index of FM energy was used to rank order the five responses within each test for comparison with an examiner's visually-based decisions.

Spectrum analysis data reduction

The CSRE software was designed to perform spectral analyses of speech, employing Fast Fourier Transforms (FFTs), Modified Covariance (MC), and Autocorrelation (AC) techniques. The resulting spectral pattern can be displayed on a computer screen using a magnitude (in dB) x frequency (in Hz) x time (in ms) scale. Spectrum data files were saved on computer disk for additional off-line processing.

It was determined during trial analyses that the Modified Covariance technique was the optimum method of spectrum decomposition for short duration responses. This method is also recommended by the software manufacturer. Signal pre-emphasis was set at 90% to compensate for approximately 6 dB per octave roll-off of voiced speech, largely due to radiation at the lips.

## Results

Visual analysis of pitch waveforms

Examples of pitch contours are shown in the top panels of Figures 1 and 2. The dot plots illustrate the discontinuous changes around the dominant pitch frequency. Each dot represents a point of inflection indicating a change in pitch frequency. The question regarding the completion of an anagram for the number 64 is defined as the target number question. All other questions are defined as non-target number questions. The pitch contour in Figure 1 (deceptive subject, response to non-target number question) shows multiple points of inflection with relatively large excursions when compared with Figure 2 (same subject, response to target number question).

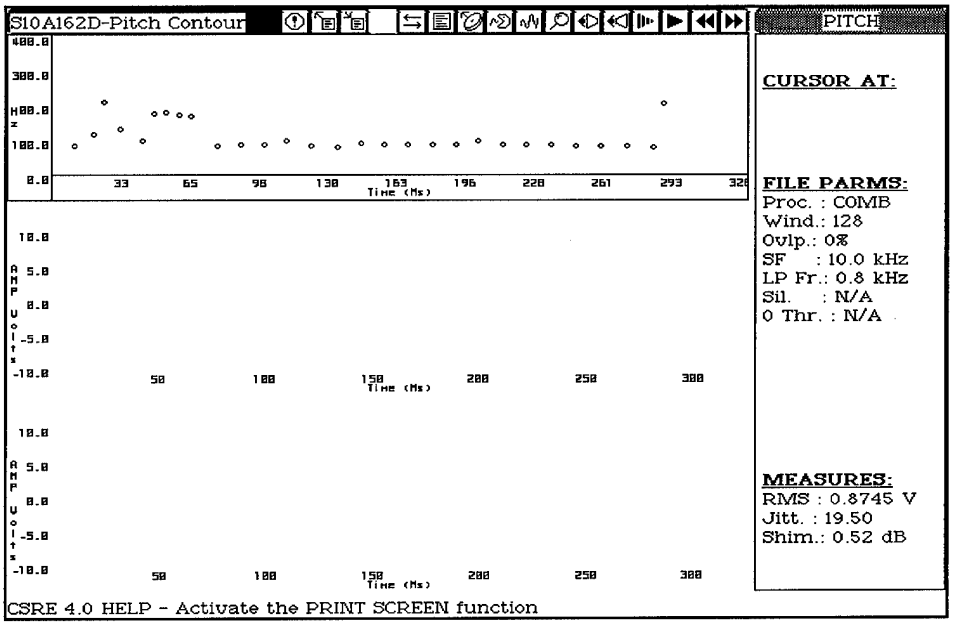



**Figure 1**. Pitch contour (top panel) of a deceptive subject's response to a non-target number, showing large pitch variations throughout the response.

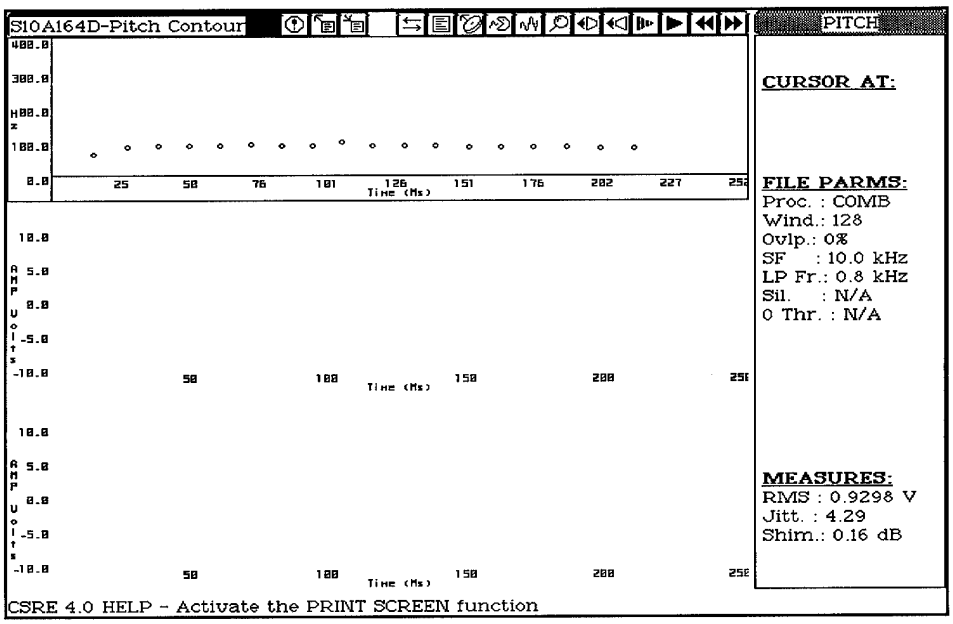



**Figure 2**. Pitch contour (top panel) of a deceptive subject's response to a target number question, showing an absence of pitch variations throughout the response.

Graphics software was used to examine the continuous pitch contours of the five responses within a test (Figures 3, 4, and 5). It can be seen that the pitch waveform of a programmed "deceptive" subject's response (Figure 3) is represented by a relatively straight

line during the target number question response (middle waveform), with little change in the dominant pitch frequency. However, the responses to questions before and after the target show obvious deviations (FM component) from the dominant frequency, especially during responses 1, 4, and 5. This was not the case for responses from a programmed "non-deceptive" subject (Figure 4). All five waveforms recorded from that subject contain obvious deviations from the dominant pitch frequency. However, in many cases, subjects programmed "deceptive" showed the same pattern of responses as a programmed "non-deceptive" subject (Figure 5), and in others, the opposite pattern was seen (Figure 6).

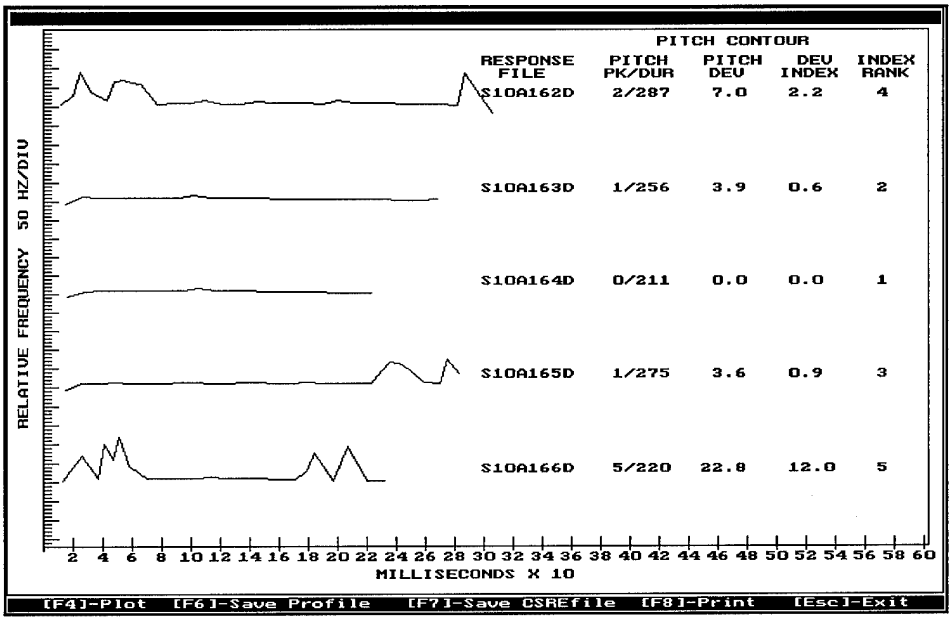



**Figure 3**. Pitch contours of a deceptive subject's responses to five questions, showing an absence of pitch variations in the response to the target number questions (third waveform).

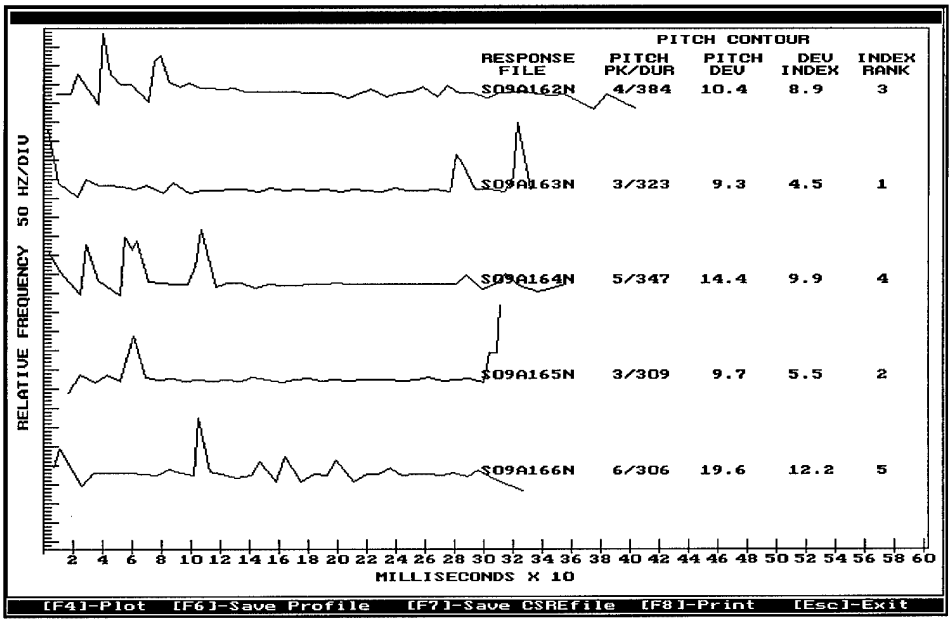



**Figure 4**. Pitch contours of a non-deceptive subject's responses to five questions, showing large pitch variations during all responses.

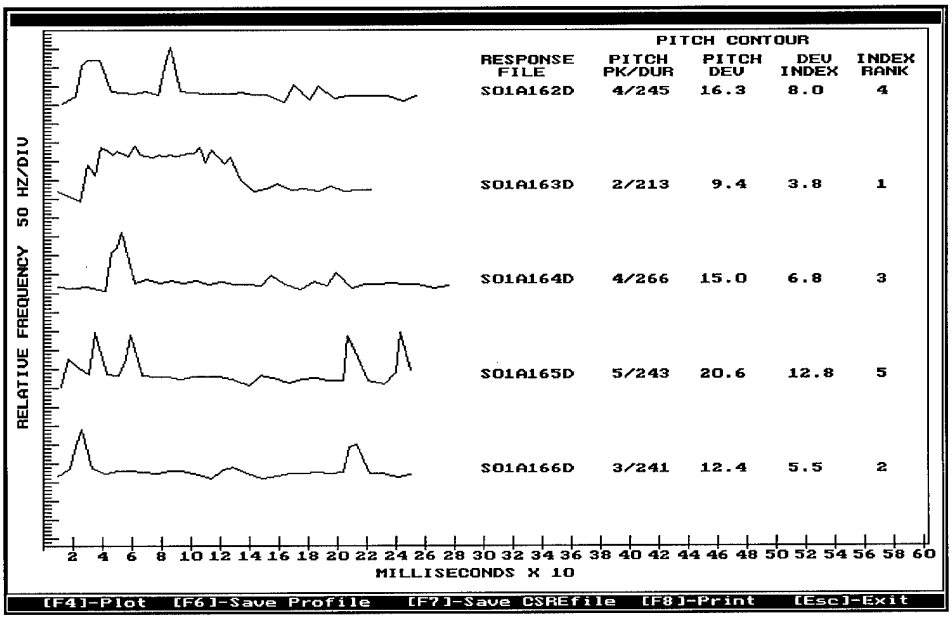



**Figure 5**. Pitch contours of a second deceptive subject's responses to five questions, showing pitch variations during all responses.

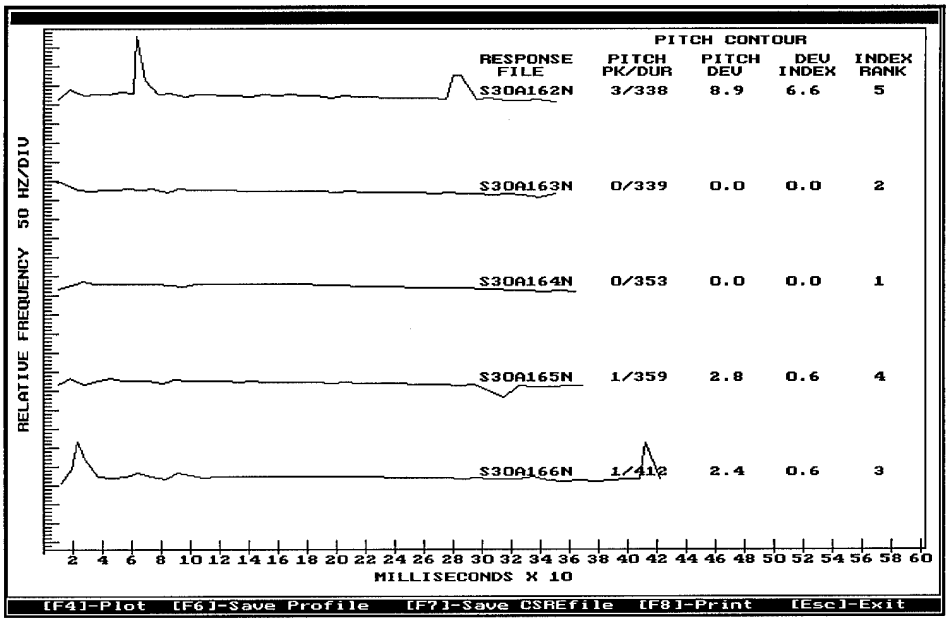



**Figure 6**. Pitch contours of a second non-deceptive subject's responses to five questions, showing an absence of pitch variations in the response to the target number question (third waveform).

Pitch data analysis

A certified forensic psychophysiologist at the DoD Polygraph Institute independently examined subjects' physiological data to determine which number was circled by each subject. His determinations were based on chart tracings of two pneumo channels, the cardio channel, and the GSR channel. Where no determination could be made by the examiner, the data were dropped from the analysis, leaving 50 tests out of a possible 84 for an analysis of agreement rates. The frequency of concurrent determinations (i.e., a numbers match) made by the examiner and the FM energy index was significantly different from chance expectation ($Z = 4.0$, $p < .01$, two-tailed). In other words, both the examiner and the energy index identified some response to a particular number, whether or not it was the number circled by the subject during the anagram task. No attempts were made to determine whether a subject's responses were evaluated as DI (deception indicated) or NDI (no deception indicated) during this comparison.

Examination of the above "correct number" decisions showed that, based on subject programming of DI (target number denied by subject) and NDI (subject's target number omitted from test), the examiner had 79% correct DI decisions versus 37% correct DI decisions based on pitch/energy ranking ($Z = 3.46$, $p < .05$, two-tailed). This result indicates that there was a significant difference between the frequency of correct target number determinations made by the examiner and by the pitch/energy ranking algorithm. Further analysis indicated that the frequency of correct number determinations using the

pitch/energy ranking algorithm was not significantly greater than chance. However, the examiner had a 35% false positive rate versus a 29% false positive rate using the pitch/energy ranking algorithm ($Z = .375$, $p > .05$, two-tailed), demonstrating that there were no significant differences between the false positive rates of the two methods. There were only two cases where both the examiner and the pitch/energy ranking method concurred on a false positive decision. Three separate GROUPS (2) x TEST (3) x QUESTION (5) repeated measures analyses of variance revealed no significant differences for measures of dominant frequency, energy, or duration.

Visual analysis of spectrograms

The spectrographs were printed and subsequently analyzed by overlaying and visually inspecting the degree of spectrograph match-mismatch. Figure 7 shows the spectrographs for a subject programmed non-deceptive, with the upper spectrograph depicting the non-target number response, and the lower showing the response to the target number question. Figure 8 shows the response patterns of a subject programmed to be deceptive.

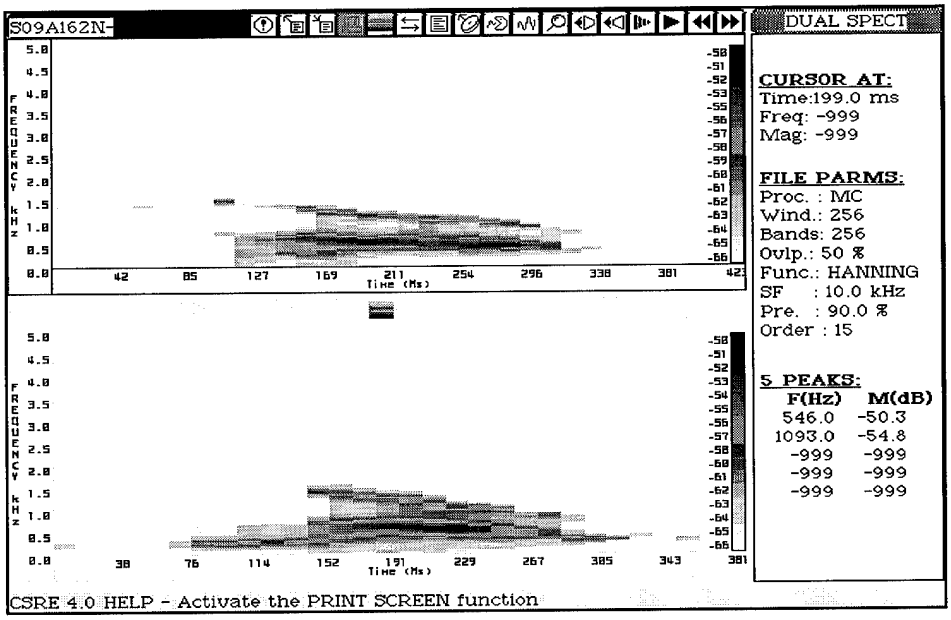



**Figure 7.** Complex spectrograph showing a non-deceptive subject's responses to a non-target (upper panel) and target number question (lower panel).

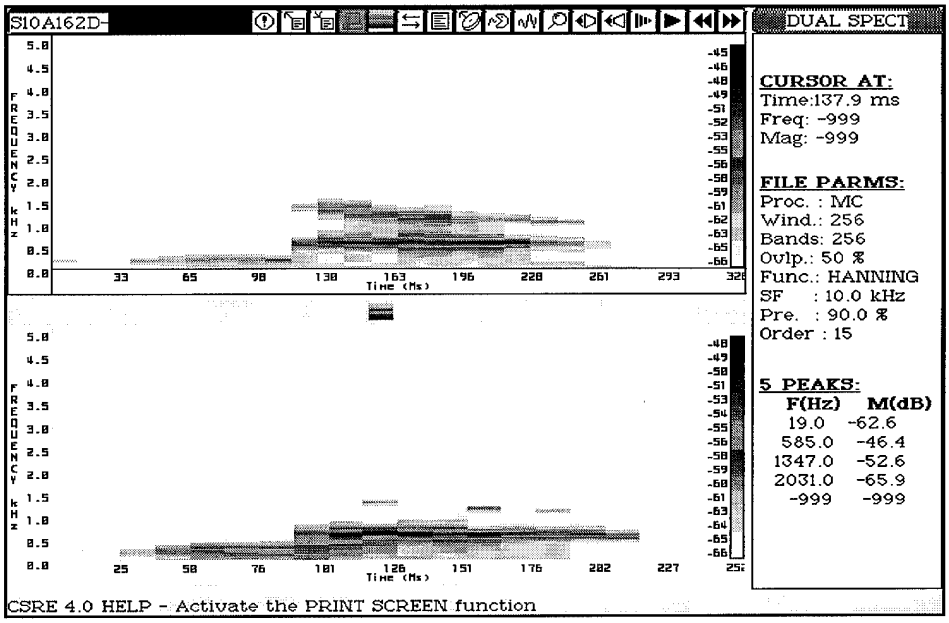



**Figure 8**. Complex spectrograph showing a deceptive subject's responses to a non-target (upper panel) and a target number question (lower panel).

Since visual inspection was determined to be too inaccurate for objective analyses, the data were collapsed across time to produce a standard amplitude x frequency spectrograph. Figures 9 and 10 are amplitude x frequency spectrographs of the data displayed in the complex spectrograph (Figure 8). The amplitude x frequency information was then divided into a series of partitions for statistical and pattern analyses.

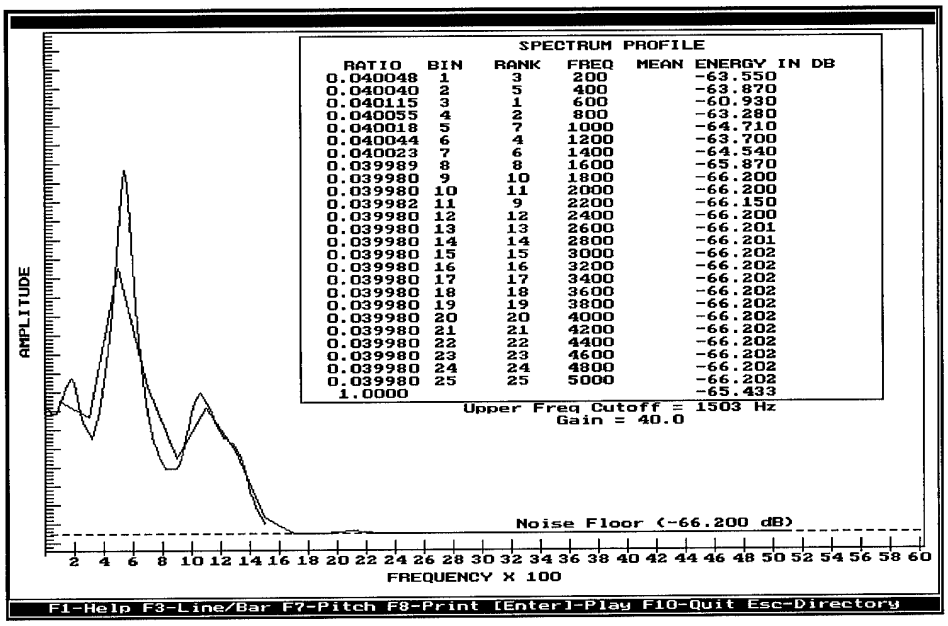



**Figure 9**. Simple spectrograph showing a deceptive subject's response to a non-target number question. Note the energy peak at 1100 Hz.

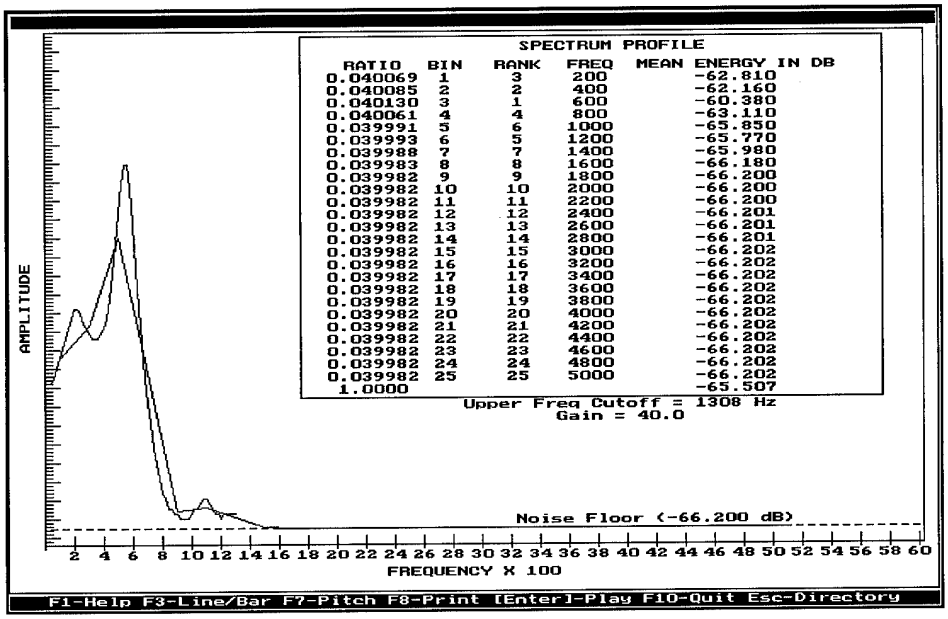



**Figure 10**. Simple spectrograph showing the same (Figure 9) deceptive subject's response to a target number question. Note the absence of energy above 1100 Hz.

Spectrum data analysis

Average magnitudes within 200 Hz bins (partitions) across the maximum allowable passband (5000 Hz) for the selected sampling rate (10 Khz) were calculated. A rank order assignment of bin magnitudes, with 1 representing the highest magnitude bin and 25 representing the lowest magnitude bin in serial order from 1 Hz to 5000 Hz, was made to generate a profile of responses for each question and subject, within a test. Since this was a relative measure, overall differences in response voice amplitude were not expected to be confounding factors.

Profiles for deceptive and non-deceptive responses were compared for congruence within each subject's data set. The dependent measure was the serial alignment (pattern match) of the 25 ranked bin values for each question with the mean ranking of the five question set. Serial alignment was assessed by non-parametric correlation (Spearman rho). The greatest pattern mismatch was expected to be associated with the question causing the most stress to the subject. A correlation of -1.0 indicates a severe misalignment of patterns, and a correlation of 1.0 is indicative of an exact pattern match. Although correlations in the direction of misalignment were seen in some cases, no systematic mismatch was found for deceptive responses to the target question.

## Discussion

Results indicated that no single human voice measure, as collected and evaluated in this study, reliably discriminated between truthful and deceptive responses. The measures examined include: dominant (fundamental) pitch frequency, voice response energy, response duration, and the magnitude and frequency of pitch changes. Within the groups sampled, the FM component had a range of 0.6 to 28.8 Hz. However, other investigators have reported that the FM component studied by Psychological Stress Evaluators (PSE) has a range of 8 to 14 Hz (Brenner, Branscomb, & Schwartz, 1979). It is, thus, not clear whether this FM component is equivalent to the PSE or is a measure of some other component.

Although other investigators have reported that a short duration response was a reliable indicator of deception (e.g., Motley, 1974), the results of the present study indicate that duration is an unreliable index of deception. Response duration may be susceptible to cognitive countermeasures (e.g., intentional changes in response duration). Changes in voice intensity (speech amplitude) were not indicative of deceptive responses and may also be susceptible to countermeasures. Various pitch parameters, however, are associated with parasympathetic nervous system activity (the vagus nerve innervates the laryngeal muscles controlling certain aspects of speech), and are not under voluntary control. Streeter, et al, (1977) found that the F0 of subject responses was higher during deceptive than non-deceptive responses. That relationship was not found in this study. However, instantaneous changes in the fundamental pitch frequency, and the magnitude of those changes may be related to emotional arousal or stress. The FM energy component, derived from the instantaneous

change measure and magnitude, may serve as a more reliable indicator of truth or deception than any single voice measure.

Lieberman and Michaels (1962) reported that the ability of observers to correctly identify emotional states of subjects dropped significantly when all pitch information was removed from subjects' recorded responses. In the present study no significant systematic relationship was found between the FM energy component, derived from pitch, and deceptive responses. However, a higher correct decision rate was found when the FM energy component was compared to any of the single measures investigated. Since the verbal responses were collected during a peak-of-tension polygraph examination, and only a single voice response was recorded immediately after each question, there may not have been sufficient time for a stress response to appear in the recorded waveform. Further investigations might employ a restructured question format with more than one response after each question, or instructions to subjects to delay their verbal responses. This may increase the likelihood that a delayed stress related response will be captured.

A weighted combination of mean response intensity, response duration, and the FM energy component may prove to be a reliable additional polygraph channel. Speech formant structures and a more stringent analysis of spectrum data should be examined in further studies, and added to the final equation. Computer programs employing neural networks, fuzzy logic, or other "smart" procedures may, in the future, identify response characteristics within a polygraph session and adjust weights accordingly to provide increased levels of confidence in that channel's decision output. However, the results of this research, and of the reviewed studies, suggest that voice stress analysis within the context of a standard PDD examination is not yet a reliable and valid discriminator of truth and deception.

## References


Barland, G. H. (1978). Use of voice changes in the detection of deception. Polygraph, 7, 129-140.

Brenner, M., Branscomb, H. H., & Schwartz, G. (1979). Psychological stress evaluator - two tests of a vocal measure. Psychophysiology, 16, 351-357.

Dollins, A. B., Cestaro, V. L., & Pettit, D. (1994). Efficacy of repeated psychophysiological detection of deception testing (Report No. DODPI-R-0013). Fort McClellan, AL: Department of Defense Polygraph Institute.

Fay, P. J., & Middleton, W. C. (1941). The ability to judge truth-telling or lying, from the voice as transmitted over a public address system. The Journal of General Psychology, 24, 211-215.

Horvath, F. H. (1982). Detecting deception: The promise and the reality. Journal of Forensic Science, 304-318.

Lieberman, P. (1961). Perturbations in vocal pitch. The Journal of the Acoustical Society of America, 33, 597-603.

Lieberman, P., & Michaels, S. B. (1962). Some aspects of fundamental frequency and envelope amplitude as related to the emotional content of speech. The Journal of the Acoustical Society of America, 34, 922-927.

Motley, M. T. (1974). Acoustic correlates of lies. Western Speech, 81-87.

O'Toole, G. (1975). The Assassination Tapes. New York: Penthouse Press Ltd.

Streeter, L. A., Krauss, R. M., Geller, V., Olson, C., & Apple, W. (1977). Pitch changes during attempted deception. Journal of Personality and Social Psychology, 35, 345-350.

Tolkmitt, F. J., & Scherer, K. R. (1986). Effect of experimentally induced stress on vocal parameters. Journal of Experimental Psychology, 12, 302-313.

Appendix A

Response Chart

**60 - NO**

**61 - NO**

**62 - NO**

**63 - NO**

**64 - NO**

**65 - NO**

**66 - NO**

Appendix B

Description of Research

**WELCOME**: Welcome to the Department of Defense Polygraph Institute. This may be the first time you have been to the Institute so we would like to provide you with some information concerning your visit today. PLEASE REMEMBER that your participation is entirely voluntary - you are free to leave at any time. If you have any questions, please feel free to ask the individuals assisting you.

**Research Title**: Efficacy of Repeated Psychophysiological Detection of Deception Testing (June 9, 1993)

**Principal Investigator**: Dr. Andrew B. Dollins, DoDPI Research Psychologist

**BACKGROUND / SIGNIFICANCE**: The Psychophysiological Detection of Deception (PDD) is a process believed to determine whether an individual is responding truthfully to a series of questions. PDD is commonly called "lie detection" or "polygraph" test. The process is based on the assumption that an individual who is deceptive (i.e., lying) has a greater response in some body systems than a person who is not. While this is generally true, it is not known whether an individual always responds in the same way when being deceptive. This project is designed to test the consistency of responses when an individual is lying and is telling the truth.

YOU SHOULD NOT PARTICIPATE IN THIS STUDY IF YOU:

1) Previously participated in a PDD examination.
2) Are taking prescription medication.
3) Have a history of dizziness or fainting spells.
4) Have been diagnosed with a heart condition.
5) Have been diagnosed with high blood pressure.
6) Have been diagnosed with a respiratory ailment, especially asthma or emphysema.
7) Currently suffer from an acute health problem such as a cold, active allergy problem, hemorrhoidal problem.

**PROCEDURES**: During this project you will be asked to participate in two research sessions lasting approximately four hours each. These two sessions will be separated by five to ten days as scheduling permits. During each session you will be asked to complete a puzzle and, possibly, to lie about the puzzle during a PDD examination. Some people will be asked to lie about the puzzle they completed and some will not be asked questions about the puzzle. If you are asked questions about the puzzle you completed, YOUR TASK IS TO LIE SUCCESSFULLY, to the PDD examiner concerning the puzzle.

Participation in the PDD process is relatively simple. The examiner will ask several questions concerning your age, health, and normal daily activities. He will then briefly

explain the theory of the Psychophysiological Detection of Deception and review the questions he will ask during the examination with you. With your permission, the examiner will then attach sensors to your body. Two small flat metal sensors will be attached to the first and third fingers of one hand. Expandable tubes will be put around your upper and lower chest. A blood pressure cuff will be wrapped around your arm. You will be asked to sit still for several minutes while the examiner asks the questions he reviewed earlier. The examiner may ask the same questions several times during the examination. When the session is complete, we will make an appointment for your second session and you will be escorted out of the building. The second session will be like the first except this briefing will not be repeated.

**DISCOMFORTS**: Some people find it difficult to sit still for several minutes at a time during the PDD test while physiological reactions are recorded. Part of the PDD process requires the wearing of an inflated blood pressure cuff, which some people find moderately uncomfortable. The examiner is sensitive to this discomfort and will attempt to make the process as brief as possible. The actual tests last approximately five minutes each. You will be asked to participate in as many as nine tests during each examination day. The total length of time that you will actually be participating in a polygraph examination is 45 minutes to two hours, however, you may be at DoDPI for three or four hours.

**VIDEOTAPING**: All examinations conducted during this project will be videotaped using wall and ceiling mounted video cameras and commercial videotape recorders. The tapes collected will be maintained until the operational and data analysis portions of the project are complete. At that time the video tapes will be erased and made available for re-use by the research and instruction divisions.

**RISKS**: There are no known risks involved in this study.

**CONFIDENTIALITY OF RECORDS**: You will not be asked any personal questions by the examiner, except medically related information necessary for this study. Neither your identity nor any information you reveal during this project will be released to anyone not directly involved in the research. Members of the U.S. Army Surgeon General's Human Subjects Research Review Board may inspect the research records in their capacity as reviewing officials.

**YOUR RIGHTS**: You have the right to ask any questions about any aspect of your participation in the study. If any problems arise at any time in conjunction with your involvement in the study, or if you have been injured in any way as a result of the study, the person to contact is the Chief of Research, Department of Defense Polygraph Institute. In the event that you do have questions or any of the above has occurred please contact Dr. William Yankee at (205) 848-3803. Should any question arise concerning study-related injury, you may contact the Director of the Noble Army Community Hospital, Fort McClellan, Alabama, 36205, telephone number (205) 848-2200.

**VOLUNTARY PARTICIPATION**: Your participation in this study is completely voluntary. **If you would prefer not to participate, do not volunteer for it!** Even if you decide to participate in the study, you may discontinue at any time without penalty or loss of benefits to which you are entitled. Should you decide not to participate, please inform someone on the staff at the Department of Defense Polygraph Institute, or if it occurs during the polygraph examination itself, inform the examiner and you will be released without censure.

**ADDITIONAL COMMENTS**: Regardless of whether you are required to lie during the PDD examination, it is very important that you do not tell the examiner whether you are being truthful or not. Examiners should not ask and if they do, please tell another staff member. It is also VERY IMPORTANT that you do not discuss your experiences in the PDD examination with your fellow research participants. If either of the above occurs, you will be withdrawn from the study without further benefit.

Appendix C

Informed Consent Affidavit

This form is affected by the Privacy Act of 1974.

1. **AUTHORITY**: 10 USC 3012, 44 USC 3101 and 10 USC 1071-1087.

2. **PRINCIPLE PURPOSE**: To document voluntary participation in a DoD Polygraph Institute Research Program.

3. **ROUTINE USES**: Your name will be used for identifying and locating research documents and will be available only to individuals associated with the research project.

4. **MANDATORY OR VOLUNTARY DISCLOSURE**: Your signature is necessary if you want to be included in this research. If you do not sign, you will not be able to participate in this study and you will not be paid.

---

PERSONAL STATEMENT

I, _____, being at least 19 years old, do hereby volunteer to participate in a research study titled "Efficacy of Repeated Psychophysiological Detection of Deception Testing" being conducted at the Department of Defense Polygraph Institute, under the direction of Andrew B. Dollins, Ph.D.

1._____ I understand that I am participating in a research study to examine several measures and techniques, some of which are currently employed in criminal and/or security screening situations where the Psychophysiological Detection of Deception (PDD) is used. PDD is commonly called a 'polygraph test' or 'lie detector'.

2. To the best of my knowledge,

A._____ I am not taking any prescription medication.

B._____ I have no history of dizziness or fainting spells.

C._____ I have not been diagnosed as having, nor do I believe that I may have any of the following:

1) Heart condition.
2) High blood pressure.
3) Any respiratory ailment, especially asthma or emphysema.

D._____ I do not now have any acute health problems such as a cold, an active allergy problem, and an active hemorrhoidal problem.

3._____ I am aware that I will be spending approximately four (4) hours at the DoD Polygraph Institute (DoDPI) on two occasions, and that I may be asked to conceal information concerning my activities at DoDPI from a trained Forensic Psychophysiologist.

4._____ I understand that as a part of this study I will be participating in a PDD examination during which I will be asked to sit still for several minutes at a time while physiological measurements are recorded from my body.

5._____ I understand that there are no known dangers or risks associated with my participation in this study.

6._____ I understand that I will be required to wear an inflated blood pressure cuff, which some people find moderately uncomfortable, during the PDD examination.

7._____ I understand that I will be videotaped during the PDD examination and that the videotape will be maintained until data analyses are complete.

8._____ I understand that I will receive no reward or benefit of any kind as a result of my participation in this study.

9._____ I understand that I may terminate my involvement in this study at any time and for any reason, without censure.

10._____ I understand that my participation in this project will be terminated if I discuss the details of my participation with anyone except project supervisory personnel. NOTE: Discussion of details with other participants would invalidate the data collection.

11._____ I understand that I should contact the principal investigator, Dr. Andrew Dollins, and / or the DoD Polygraph Institute Director, Dr. William Yankee [Tel: (205) 848-3803] if I have any concerns or complaints regarding this study.

12._____ I understand that any questions concerning my rights relating to study-related injury should be directed to Colonel Weisser, MD, Director of the Noble Army Community Hospital, Fort McClellan, Alabama, 36205, tel (205) 848-2200.

13._____ I have been given a thorough explanation of the nature, purpose, methods, and duration of my participation in this investigation. I have been given the opportunity to ask any questions I have concerning the investigation and all questions have been answered to my full satisfaction.

| | |
|---|---|
| _____ | _____ |
| Participant Signature | Witness Signature |
| _____ | _____ |
| Printed Name | Printed Name |
| _____ | _____ |
| Date | Date |

Appendix D

Pre-Test Questionnaire

Participant number:_____ Date of completion:_____

Please carefully complete all of the blanks below:

Name (Please Print):_____Gender:( )M ( )F

Occupation:_____ Age:_____

Hours of sleep last night:_____

Previous PDD Examination: ( )Yes ( )No

Have you ingested alcohol, nicotine, or caffeine (including coffee, tea, soft- drinks, and chocolate) within the last 24 hours? ( )Yes ( )No

If so, what and when? _____

_____

How would you describe your present health and physical well being?
( )Excellent ( )Good ( )Fair ( )Poor

Are you presently under a physician's care and are you taking any medication?
( )Yes ( )No

If so, for what condition?_____

Please identify the type, dosage, and last time any medication was taken:

_____

Are you experiencing any pain or discomfort today?
( )None ( )Mild ( )Moderate ( )Severe

Reason for any pain or discomfort today_____

Appendix E

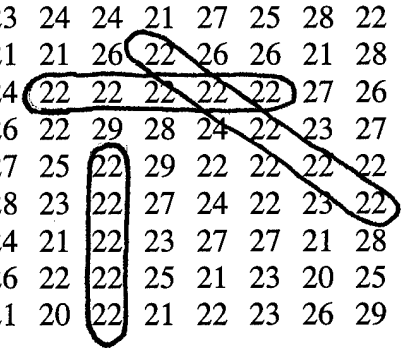
## Anagram Task 64

Please locate and circle six sequences of the number which is repeated five times below. (See example for the number 22 on the right.)

Name:_____

Subject #:_____ Date:_____

Score:_____ (EoRPDD 07/12/93 6A)



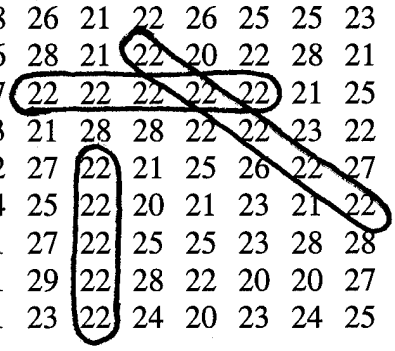

66 62 64 61 61 63 65 64 67 66 66 66 61 64 63 64 65 66 67 62
68 69 63 66 67 61 65 68 68 67 68 68 65 65 65 66 68 63 68 68
68 62 69 62 65 66 64 64 64 64 64 68 69 66 66 66 61 62 67 66
61 64 63 61 63 66 68 69 69 64 69 67 66 66 63 63 65 60 62 65
67 66 67 62 65 64 61 65 61 66 62 62 68 60 66 64 67 62 65 66
68 60 68 69 68 65 63 60 63 69 65 68 67 67 65 64 67 68 66 65
64 69 65 62 60 62 60 65 62 69 68 62 67 61 61 64 67 68 62 63
67 69 65 64 63 69 65 64 62 61 65 61 64 67 66 64 69 65 62 67
65 60 65 61 68 68 60 68 65 66 62 68 61 69 68 64 65 66 61 63
65 68 65 63 64 61 65 62 64 65 62 63 65 67 63 67 63 62 69 63
65 66 64 63 66 64 67 65 64 64 60 60 68 66 64 68 66 62 63 67
67 61 65 60 65 61 61 63 63 67 64 62 61 63 68 61 67 64 67 60
67 68 67 69 64 68 68 61 63 66 64 64 63 67 66 60 66 69 63 61
61 68 66 61 69 69 61 67 69 62 68 67 64 61 64 62 66 66 61 63
62 60 67 61 63 61 68 65 64 63 69 64 63 63 63 65 60 65 64 65
68 68 61 64 63 68 64 62 62 67 67 68 62 63 65 67 60 66 64 63
69 61 62 61 68 61 66 64 65 67 64 60 63 68 68 68 64 63 64 65
62 67 62 61 61 62 67 66 61 65 65 65 62 62 65 69 61 62 64 66
64 62 62 63 67 62 63 67 63 63 60 61 60 63 63 66 60 63 64 62
63 64 64 62 67 66 61 61 63 66 66 66 64 66 64 63 68 67 67 68
68 66 67 64 64 64 64 64 61 61 62 63 66 61 65 65 62 65 64 61
65 65 63 62 69 69 62 68 62 69 68 66 67 65 69 69 61 65 62 63
64 62 65 63 69 67 65 64 67 66 65 65 63 63 65 62 61 68 67 67
64 64 63 67 65 69 64 61 60 68 68 68 62 67 62 65 67 66 66 60
66 62 61 63 62 66 65 62 60 60 67 65 65 60 65 64 63 69 65 67
65 69 67 60 62 67 61 64 63 68 61 65 65 66 66 67 68 60 67 64
64 66 61 66 63 63 64 68 61 68 61 62 61 66 62 64 68 61 61 68
63 69 61 67 63 64 67 67 62 67 67 64 63 69 64 64 68 67 61 61
60 62 62 65 64 68 64 67 61 68 61 67 62 64 63 61 62 62 69 65

(Truncated)

Appendix F

Anagram Task 84

Please locate and circle six sequences of the number which is repeated five times below. (See example for the number 22 on the right.)




Name:_____

Subject #:_____ Date:_____

Score:_____ (EoRPDD 07/12/93 8A)

86 82 84 81 81 83 85 84 87 86 86 86 81 84 83 84 85 86 87 82
88 89 83 86 87 81 85 88 88 87 88 88 85 85 85 86 88 83 88 88
88 82 89 82 85 86 84 84 84 84 84 88 89 86 86 86 81 82 87 86
81 84 83 81 83 86 88 89 89 84 89 87 86 86 83 83 85 80 82 85
87 86 87 82 85 84 81 85 81 86 82 82 88 80 86 84 87 82 85 86
88 80 88 89 88 85 83 80 83 89 85 88 87 87 85 84 87 88 86 85
84 89 85 82 80 82 80 85 82 89 88 82 87 81 81 84 87 88 82 83
87 89 85 84 83 89 85 84 82 81 85 81 84 87 86 84 89 85 82 87
85 80 85 81 88 88 80 88 85 86 82 88 81 89 88 84 85 86 81 83
85 88 85 83 84 81 85 82 84 85 82 83 85 87 83 87 83 82 89 83
85 86 84 83 86 84 87 85 84 84 80 80 88 86 84 88 86 82 83 87
87 81 85 80 85 81 81 83 83 87 84 82 81 83 88 81 87 84 87 80
87 88 87 89 84 88 88 81 83 86 84 84 83 87 86 80 86 89 83 81
81 88 86 81 89 89 81 87 89 82 88 87 84 81 84 82 86 86 81 83
82 80 87 81 83 81 88 85 84 83 89 84 83 83 83 85 80 85 84 85
88 88 81 84 83 88 84 82 82 87 87 88 82 83 85 87 80 86 84 83
89 81 82 81 88 81 86 84 85 87 84 80 83 88 88 88 84 83 84 85
82 87 82 81 81 82 87 86 81 85 85 85 82 82 85 89 81 82 84 86
84 82 82 83 87 82 83 87 83 83 80 81 80 83 83 86 80 83 84 82
83 84 84 82 87 86 81 81 83 86 86 86 84 86 84 83 88 87 87 88
88 86 87 84 84 84 84 84 81 81 82 83 86 81 85 85 82 85 84 81
85 85 83 82 89 89 82 88 82 89 88 86 87 85 89 89 81 85 82 83
84 82 85 83 89 87 85 84 87 86 85 85 83 83 85 82 81 88 87 87
84 84 83 87 85 89 84 81 80 88 88 88 82 87 82 85 87 86 86 80
86 82 81 83 82 86 85 82 80 80 87 85 85 80 85 84 83 89 85 87
85 89 87 80 82 87 81 84 83 88 81 85 85 86 86 87 88 80 87 84
84 86 81 86 83 83 84 88 81 88 81 82 81 86 82 84 88 81 81 88
83 89 81 87 83 84 87 87 82 87 87 84 83 89 84 84 88 87 81 81
80 82 82 85 84 88 84 87 81 88 81 87 82 84 83 81 82 82 89 85

(Truncated)

Appendix G

Pre-Test Interview

Good morning (afternoon), my name is Don Pettit and I will be conducting the polygraph examination today. I am an instructor at the Polygraph Institute and like you I have been detailed to assist Dr. Dollins in this very import research project. You and I know that this project is very important otherwise the Army would not have provided us to participate.

Before we begin conducting any examinations I will explain everything that will be attached to you for this examination and we will have discussed a little bit about your background and one of the theories of psychophysiological detection of deception. Let me assure you that nothing will be said or done here that will in any way hurt or injure you. Do you have any questions before we proceed?

Now, I would like to review the interview work sheet.
[Review Pre-Test Questionnaire - Appendix D]

One of the theories concerning the psychophysiological detection of deception or the ability of a trained forensic pyschophysiologist (polygraph examiner) to diagnose deception is that of Fight or Flight which you may be familiar with from sports and your training in the military. This phenomenon is theorized to be what allows us to survive in dangerous or stressful situations. When the mind recognizes that we are in danger we enter into Fight or Flight and the naturally occurring narcotic epinephrine is released into the blood stream. This drug effects different organs of the body in different ways. In the case of the cardiovascular system this drug causes the activity of the heart to increase along with a marked increase in the pulse, blood pressure, and other cardiac activity.

In the case of the heart the increases are to provide more oxygen and nutrients to the large muscles of the legs and arms so we can run away from the problem or fight our way out of the problem. Additionally this provides more oxygen to the brain so we can think our way out of the problem. The epinephrine additionally effects our lungs by causing them to increase activity to better place oxygen in the blood stream and to remove carbon dioxide from the system.

The body experiences numerous other physiological changes to include changes in the sweat gland activity and the electrodermal activity at the skin. Normally these reactions are associated with fear. These reactions are what allows us to survive in stressful situations such as combat, parachuting, and other duties.

[The Examinee is then asked to provide an example of when they might have experienced this phenomenon. Common examples were as follows: 1st traffic citation; combat in South West Asia; traffic accidents; and, training mishaps.]

Well, I can tell by your example that you are familiar with these reactions. The same type of reactions occur when we are practicing deception because there is a fear of being caught in a untruthful statement or being punished for the untruth. Have you ever experienced these reactions?

Once we have told the deception, another drug is released into the blood stream which brings the body back to normal. This drug is called nor-epinephrin. This same drug aids in our recovery from dangerous situations.

With the sensitive apparatus associated with a polygraph instrument a trained polygraph examiner can diagnose when an individual has been less then truthful when answering questions while attached to the instrument. The actual attachments you that will be placed on your body are the standard hospital blood pressure cuff, to monitor your cardiac activity. Two small metal plates which will be attached to you finger tips to monitor your sweat gland activity, and two convoluted tubes which will be placed around your torso to monitor you respiratory activity. None of these attachments will cause you any pain or discomfort. Also a microphone will be placed around your neck to make an accurate recording of your verbal responses to the questions on today's test.

The examinee is then presented with the prerecorded questions for this examination.

Appendix H

Participant Debriefing Statement I

Now that you have completed your first examination, it is the desire of the entire project staff to take this opportunity to sincerely thank you for your help. Your work here may be more important than you realize.

If you participated in deceiving the PDD examiner, you are assured by the staff of this Institute, that you in no way violated any rule or law. The deception was required for investigational purposes only.

Regardless of the role you played, it is our hope that you were made to feel as comfortable as possible throughout the study. If you do have concerns or questions regarding your participation, please make them known to the principal investigator, Dr. Andrew Dollins, and / or the DoD Polygraph Institute Director, Dr. William Yankee [Telephone number: (205) 848-3803].

Finally, it is VERY IMPORTANT that you DO NOT discuss the details of this study with anyone else. One of your friends, or a friend of a friend, may decide to participate in this or a similar study someday. If they know the details of the investigation process, they could be disqualified from participating in a study and/or unconsciously influence the results of the study using their GUILTY KNOWLEDGE. If you reveal the details of this study to another person we will also be forced to terminate your participation in this study.

Please sign this form in the space provided to indicate that you understand the instructions provided above.

_____

Participant Signature

_____

Printed Name

_____

Date

Appendix I

Participant Debriefing Statement II

Now that you have completed your role in our research, it is the desire of the entire project staff to take this opportunity to sincerely thank you for your help. Your work here may be more important than you realize.

The results of this study may include information which will provide federal agencies and police departments with a better understanding of how to change existing PDD examinations to accurately determine when an individual is being truthful.

If you participated in deceiving the PDD examiner, you are assured by the staff of this institute, that you in no way violated any rule or law. The deception was required for investigational purposes only.

Regardless of the role you played, it is our hope that you were made to feel as comfortable as possible throughout the study. If you do have concerns or questions regarding your participation, please make them known to the principal investigator, Dr. Andrew Dollins, and / or the DoD Polygraph Institute Director, Dr. William Yankee [Telephone number: (205) 848-3803].

Finally, it is VERY IMPORTANT that you DO NOT discuss the details of this study with anyone else. One of your friends, or a friend of a friend, may decide to participate in this or a similar study someday. If they know the details of the investigation process, they could be disqualified from participating in a study and/or unconsciously influence the results of the study using their GUILTY KNOWLEDGE.

Please sign this form in the space provided to indicate that you understand the instructions provided above.

_____

Participant Signature

_____

Printed Name

_____

Date